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IMPROVEMENT OF KENTUCKY BLUEGRASS THROUGH BREEDING AND SELECTION

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by

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IMPROVEMENT OF KENTUCKY BLUEGRASS
THROUGH BREEDING AND SELECTION

To: J. F. McLaughlin, Director
Joint Highway Research Project

September 12, 1968

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From: H. L. Michael, Associate Director
Joint Highway Research Project

Project: C-36-48C

Attached is a Progress Report on the HPR Part II research project titled "Research in Roadside Development and Maintenance." This report is the first major progress report on Part I "Bluegrass Research" and is titled "Improvement of Kentucky Bluegrass Through Breeding and Selection". The report has been authored by Professor W. H. Daniel, the principal investigator, and T. P. Riordon, Graduate Assistant.

The report summarizes the 1965 space planting of 3,900 plants and data collected for their evaluation. The procedures and plant characteristics evaluated are discussed and plans for continuing work are given.

The report is presented for the record. Comments and suggestions are solicited. The report will also be forwarded to the ISHC and the BPR for their review, comment and approval of the report as partial fulfillment of the objectives of the research project.

Respectfully submitted,

Harold L. Michael
Associate Director

HLM:lh

Attachment

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Progress Report

RESEARCH ON ROADSIDE DEVELOPMENT AND MAINTENANCE

Part I Bluegrass Research

IMPROVEMENT OF KENTUCKY BLUEGRASS THROUGH BREEDING AND SELECTION

by
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in cooperation with the

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and the

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Bureau of Public Roads

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or the
Bureau of Public Roads

Purdue University
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INTRODUCTION

Three space plantings of Kentucky bluegrass were made with the goal of selection of the outstanding roadside type. Space plantings, made in 1965, 1966, and 1967, have been the basis for the screening of 10,000 individual bluegrass plants for certain important turf characters. It is expected that plants will be selected which are better adapted to specific highway uses.

The data contained in this paper are derived from the 1965 space planting. At the present time the 1966 space planting is being analyzed and data are still being taken from the 1967 materials. These later plantings and a planting in the fall of 1968 will be included in a Ph.D. study which is underway.

PROCEDURES

IBM card sorting was used in order to rank plants according to desired characteristics, thus allowing selection of plants for highway types. The characteristics studied and a brief explanation of the character in regard to its importance and its range in variation follow. (The characters are listed in the proposed order of importance):

1. Leaf height represented the distance in inches from the ground level to the uppermost leaf tip in the non-seeding stage. Three measurements were made in order to study variation caused by the season

of the year. Leaf height was measured in order to aid in decisions of possible use of growth types; for example, low-growing for level roadsides and high-growing for sloping areas. There was a range from 1 inch to 16 inches for the leaf height characteristic.

Figure 1. Low Leaf Height Shown by Unmowed Experimental Selections.

2. Overall rating was rated visually after plants had recovered from the effects of seed harvest. A rating of one (best) to nine (poorest) was used to give a final check of all plants concerning their suitability for final selection and seed increase. Only 10% of the plant material was given a rating better than seven.

3. Spread was measured three times using a calibrated linear scale of nine equal increments with a rating of one being the preferred widest, and nine the least rhizome spread. This character is a guide in the selection of vigorous plants, which would allow a ground cover to be obtained quickly, and would permit rapid recovery from disease. Spread was found to range from 1 to 36 inches in one year.

Figure 2. Spread of 1 (36") on Left and 8 (8") on Right.

Figure 3. Spread Obtained after Two Years Growth.

4. Rust resistance was measured by a visual rating with one representing the desired very little or no infestation, progressing to a rating of nine indicating a plant which had completely succumbed to the disease. Plants with rust resistance were selected because of aesthetic value, improved overall hardiness, and increased seed field yields. Less than 25% of the plant material was found to have the desired rust resistance.

5. Leaf color was given a visual score ranging from one for a dark green plant to nine for the most yellow-green plant. Dark green color was selected because of consumer preference and reduced need for nitrogen for greener color. Approximately 35% of the plant material was found to have the darker green color.

Figure 4. Color Differences Shown in Mature Space Plants.

6. Panicle height denoted approximately the average distance in inches from the ground level to the uppermost tip of the panicle after elongation had ceased. The panicle or seedhead height ranged from 3 inches to 33 inches, but it is believed that 15 inches should be the maximum height because unnecessary stem material leads to increased thatch and disease. Panicle height along with panicle quantity and maturity were measured or rated as an aid to the prospective seed producer.

Figure 5. Panicle Height of Common Bluegrass on Left Compared to that of Experimental on Right.

7. Panicle quantity was measured by a visual rating, ranging from one for the plants appearing to have the largest yield of seed to nine for plants having no seed. The majority of the plants have

medium seed yields, but it is felt that these yields are acceptable.

8. Panicle maturity was rated from one representing the plants earliest to produce seed ready for harvest, progressing to a nine rating for the latest, green seedheads. Generally, those plants having the latest maturity have the best turf characteristics. Approximately 30% of the plant material is considered to have a late maturity.

9. Winter survival was measured by a visual rating with a rating of one having no damage and a rating of nine having no survival. This character was rated in order to eliminate those few obvious plants (about 4%) that were unable to survive the winter season.

RESULTS AND CONCLUSIONS

Card sorting was used to select the more outstanding plants of low, medium and high leaf height classes. Table 1 lists the five outstanding plants of each class and shows the differences in the pertinent data. The class averages and the population averages for the different characteristics are included so that the degree of improvement may be observed.

Leaf height average is the average of the three times of measurement for the leaf height characteristic. This character was used to classify the better plants into the low, medium and high classes.

Spread average is the average of the three times of measurement for the characteristic of spread. It may be seen that the high leaf

Table 1. Selected Bluegrass Plants.

Class and Rank	Selection	Leaf ht. avg.	Spr. avg.	O. rating	Col.	Rust rest.	Wint. surv.	Panicle ht.	Panicle quan.	Panicle matur.
Low										
1	A10	3.7	2.3	5	4	3	1	21	6	6
2	16B72	1.7	3.0	3	5	2	1	2	8	8
3	16B72	3.0	3.0	4	5	2	1	4	6	8
4	16B828	3.3	3.0	4	5	2	1	8	5	8
5	16B30	3.1	3.3	5	5	2	1	6	7	8
Class avg.		3.0	2.9	4.2	4.8	2.2	1.0	8.2	6.4	7.6
Med.										
1	16B185	5.3	1.0	4	5	4	1	12	5	5
2	16B248	6.0	1.0	4	3	2	1	16	4	6
3	16B18	5.0	1.3	5	2	3	1	14	3	6
4	16B248	6.3	1.3	4	3	2	1	16	4	6
5	16B25	6.0	1.3	4	3	2	1	14	4	6
Class avg.		5.7	1.2	4.2	4.2	2.6	1.0	14.4	4.0	5.8
High										
1	16B18	7.9	1.0	5	5	2	1	14	3	6
2	16H	6.7	1.0	4	4	4	1	27	5	6
3	16B24xB17	8.7	1.0	4	4	1	1	18	4	6
4	16B188	8.3	1.0	4	4	2	1	18	2	6
5	16B167	8.3	1.0	5	5	4	1	16	3	6
Class avg.		8.0	1.0	4.4	4.4	2.6	1.0	18.6	3.4	6.0
Avg. 3,900 Pls.		5.1	3.3	9.0	4.0	5.0	1.2	16.1	4.2	6.0

height class has greater spread (rating of 1.0) than the low or medium leaf height classes. It is believed that the medium and especially the high-growing plants, because of their greater spread, may be better for roadsides where there is slope and an erosion problem.

Though the overall ratings (O.R.) for the selected plants are only medium (3-4-5), there is much improvement over the population average of 9.0. The medium ratings and the high population

average show the severity of this rating since only the best plants with the most potential were selected as possible improved plants.

Improvement for the characteristics of color and rust resistance may be observed for the different leaf height classes though there are several exceptions. The low leaf height class has a slightly lighter green color (higher numbers) due to the low number of low-growing plants available for selection. Also, the high leaf height class appears to have less rust resistance than the remainder of the population. It is possible that these plants with greater amounts of leaf material are more susceptible to infestation by rust.

Panicle characteristics, which are of little importance when bluegrass is considered as a vegetative turf, are shown under panicle height, quantity, and maturity. It is observed that as a general rule as the leaf height increases the panicle height increases, more seed is formed, and the seed is earlier to mature. Thus, late maturing, reduced seed quantity, and low leaf heights should contribute to desired bluegrass for roadside turf.

FURTHER WORK

It is hoped that this preliminary selection from the three space plantings will lead to other bluegrass research that will allow development of turfgrasses better adapted to the different roadside uses. It is anticipated that when superior selections are proven, contract seed production between growers and the highway department could be easily arranged so that controlled amounts of seed could be available. Thus, as a contract for construction is prepared, contracts for seed production could be concurrently arranged.

As a guide to further research applicable to roadside development, the following short outline is given:

1. Chromosome counting of about 50 selections will be done. This will give information necessary to the possible hybridization of bluegrass plants, thus, allowing the selection of improved bluegrass plants to be more quickly obtained.

2. Determination of percentage of apomixis of the same 50 selections will be carried out. This will allow improved types that are non-sexual to be selected, and therefore will remain true to type. This means that if a superior type of plant is found, it will remain superior through apomixis.

3. Progeny selection from the same 50 selections will be done. Since more plants are to be grown, they should be observed for the possibility of superior plants.

4. Seed increase of plants already considered to be improved will be carried out.

5. Roadside planting of improved material will be done. (There is a possibility that four and five could be done simultaneously).